1	(a)	(i)	D cholesterol ; E protein / glycoprotein / intrinsic protein / protein channel / protein pump / transport protein / carrier protein ; F phospholipid (bilayer) / phospholipid head ;	3	ACCEPT polypeptide chain DO NOT ACCEPT amino acid chain DO NOT ACCEPT extrinsic protein DO NOT ACCEPT lipids / bilayer
	(a)	(ii)	D stabilise the membrane OR maintain / affect / control / AW, fluidity OR reduces permeability to, polar / charged, particles ; E allow communication across membrane OR allow, polar / charged, particles to pass through membrane ; F to act as a barrier (to, polar / charged, particles) / select what enters or leaves cell ;	3	***mark independently of (a)(i) i.e. NO ecf*** DO NOT ACCEPT refs to rigidity / support / strength ACCEPT reduces / affects, lateral movement of phospholipids ACCEPT cell recognition / receptor site / cell signalling / cell attachment ACCEPT (acts as) selectively permeable or partially permeable membrane ACCEPT allows small / fat soluble molecules to pass through DO NOT ACCEPT separates inside from outside
	(b)	(i)	communication between cells / AW ; cell, recognition / identification ; cells work together / coordination between action of different cells ; to trigger, response / reaction (inside the cell) ;	2 max	ACCEPT example to illustrate the point, e.g. action of hormone / cytokines
	(b)	(ii)	(receptor) specific shape / described ; complementary to (shape of), trigger / named trigger / communicating ; molecule ; (trigger / AW) binds / attaches to receptor ;	2 max	ACCEPT tertiary structure DO NOT ACCEPT ref to active site ACCEPT fits / idea of lock & key in correct context DO NOT ACCEPT 'matches' DO NOT ALLOW joins / bonds / links / combines / fits
	(c)	(i)	cell surface / plasma, membrane damaged ; pigment, released / leaks out ; pigment, absorbs / takes up, the light ;	2 max	ACCEPT description of damage e.g. proteins denatured / phospholipids separate / bilayer melts DO NOT ACCEPT bilayer becomes 'more fluid' DO NOT ACCEPT 'cell membrane' unqualified ACCEPT 'cell contents' for pigment DO NOT ACCEPT 'no light transmitted' 'solution is opaque'
	(c)	(ii)	*Mark first response on each numbered line. Only return to extra points on first or second line if no response in line two or three* more samples at each temperature ; same / fixed, volume of water ; all samples same, size / surface area ; ref to further cutting to increase surface area ; pieces, rinsed / blotted, after cutting ; more (intermediate) temperatures ; same beetroot used / same part of beetroot used ;	3 max	ACCEPT repeats ACCEPT collect average / mean results DO NOT ACCEPT mass ACCEPT any method of cutting to provide larger surface area ACCEPT list of figures of additional temps between 0-100 DO NOT ACCEPT wider range of temperatures / more evenly spaced temperatures DO NOT ACCEPT leave for longer DO NOT ACCEPT idea of control
			Total	**15**	

2	**(a)**	partially / selectively ;		**DO NOT ACCEPT** semi **ACCEPT** differentially
		(facilitated) diffusion **OR** osmosis ;		**ACCEPT** plasma cell
		plasma ;		
		phospholipids ;		
		cholesterol ;	**5**	
	(b)			***Look for <u>description</u> not list of functions*** *Do not credit repetition of same point*
		1 (acting as) **antigens** ;		**ACCEPT** foreign for non-self
		2 identification / **recognition**, (of cells) as, self / non-self / AW ;		**ACCEPT** description e.g. communication *between* cells / cell responds to, chemical / signal, *from another cell*
		3 **cell signalling** / described ;		**ACCEPT** description of *attachment process* for receptor / binding site **DO NOT ACCEPT** molecule unqualified **ACCEPT** binding site for foreign antigen
		4 **receptor** / binding site, for, **hormone** / (chemical) signal / (medicinal / named) drugs ;		**ACCEPT** ref to receptors on ion channels
		5 ref. to **receptor** / binding site / trigger, on transport proteins / AW ;		**ACCEPT** bind to other cells for cell adhesion
		6 cell **adhesion** / to hold cells together (in a tissue) ;		
		7 attach to water molecules (to stabilise membrane / cell) ;		
		4 max for description		
		QWC:		
		three technical terms used and spelt correctly ;		Any **three** from: receptor, antigen, hormone, <u>cell</u> signal(ling), adhesion, recognition, <u>facilitated</u> diffusion, <u>active</u> transport
			5 max	
		Total	**10**	

3 **(a)**

description	letter
an animal cell that has been placed in water	**N** ;
an animal cell that has been placed in a strong sugar solution	**K** ;
a plant cell that has been placed in water	**L** ;
a plant cell that has been placed in a strong sugar solution	

3

(b)

water moves out of cell ;
by osmosis ;

cell has, higher / greater / less negative, water potential (than surrounding solution) / ORA ;

(water moves) down water potential gradient/from high to low water potential ;

3 max

note: this is explain not describe

ACCEPT Ψ for water potential
must be comparative – **DO NOT ACCEPT** high alone

DO NOT ACCEPT across or along water potential gradient
DO NOT ACCEPT ref to water concentration anywhere
IGNORE ref to solute potentials

(c)

small, non-polar substances
diffuse (through membrane / **phospholipid bilayer**) ;

large substances
(using), **transport** / **carrier**, proteins ;

endocytosis / **phagocytosis** / described ;

polar substances
through, pore / **channel**, proteins ;
(using), transport / carrier, proteins ;

*general – must be used in correct context, each **once only***
ref to **facilitated diffusion** ;

ref to **active transport** / use of ATP ;

4 max

QWC – technical terms spelled **AND** used in correct context ;

1

5 max

ACCEPT diffusion / diffuses

ACCEPT protein pump
DO NOT ACCEPT channel proteins here
ACCEPT pinocytosis

apply only to large / polar substances

apply only to large / polar substances
DO NOT ACCEPT ref to active transport with channel proteins

(three from: phospholipid / bilayer / diffusion / facilitated diffusion / active transport / transport protein / carrier protein / channel protein / pinocytosis / endocytosis / phagocytosis)

if protein spelled incorrectly throughout, only penalise once

4	**(a)**	**(i)**	**1** at low temperatures, all stain is in cells **OR** no stain in surrounding solution ; **2** (taken up / held) against, diffusion / concentration, gradient ; **3** at high temperature stain not held in cells ; **4** at high temperature enzymes denatured so no ATP for active transport (of stain) ; **5** use of correct comparative figs to illustrate a point ; AVP ; ;	max 2	*MP 1 awarded for observation that the stain was no longer in the surrounding solution and not for the % of cells containing the stain.* **ACCEPT** the stain is not evenly distributed between cells and solution **ACCEPT** stain doesn't move out of cells **ACCEPT** *up* the diffusion gradient **ACCEPT** solution now contains stain **ACCEPT** 0% = none / no cells (stained) *MP **1** and **3** - must be stated rather than inferred from quoted figs* **IGNORE** 'enzymes denatured' alone **CREDIT** active transport / carrier, proteins denatured **ACCEPT** mitochondria stopped working so no ATP produced e.g. 97% at 30°C but 0% at 80°C **IGNORE** figs without units
	(a)	**(ii)**	cells, dead / not respiring ; no, (metabolic) energy / ATP, to take up stain ; AVP ;	max1	**DO NOT CREDIT** 'burst' as these cannot be seen **ACCEPT** inhibitor present / membrane impermeable **ACCEPT** no functioning mitochondria
	(b)	**(i)**	(membrane) structure disrupted ; (phospho)lipid bilayer, melts / more fluid ; (membrane) proteins / carrier molecules, denatured / unable to function ; (membrane) becomes more permeable ;	max 1	*Mark first suggestion and if correct award mark – if further answers contradict first answer do not award mark.* **ACCEPT** damaged, destroyed, break down **IGNORE** *membrane,* denatured / more fluid **IGNORE** lipid *molecules* melt **ACCEPT** lose shape for denatured **ACCEPT** leaky **IGNORE** refs to bonds breaking

(b)	**(ii)**	membrane <u>permeable</u> (to stain) ; methylene blue, leaked out of cells / released to solution ; by diffusion / down concentration gradient ;	max 2	**IGNORE** leaky **ACCEPT** stain / blue / pigment, moved out **IGNORE** lost *colour* / *colour* moved out (it is in stem of question) **ACCEPT** by active transport (assuming thermostable enzymes) blue / stain, diffuses out = 2 marks
(c)		*accuracy* take readings at intermediate temperatures (between 50 °C – 70 °C) ; *reliability* take more, readings at each temperature / repetitions ;	2	*Mark first suggestion only* **DO NOT CREDIT** wider temperature range OR more temperatures unqualified OR more regular intervals **ACCEPT** take readings every 5 degrees / °C **ACCEPT** ref. to haemocytometer **ACCEPT** colorimeter used to measure colour intensity of blue solution **DO NOT CREDIT** ref to use of c<u>a</u>lorimeter **ACCEPT** repeat experiment (ideally 3 readings for each temperature) , increase the number of cells observed **ACCEPT** replica / replicate for repeat
(d)		nucleus divides / mitosis ; *idea of* : cell, swells on one side / bulges ; nucleus / cytoplasm / organelles, move into, bud / bulge ; pinches off / cell wall forms, (so bud becomes a separate cell) ;	max 2	**ACCEPT** asexual reproduction / cloning **IGNORE** cell splits, ref to genetically identical cells **IGNORE** *bud* forms on side **IGNORE** replicated DNA enters bud **ACCEPT** cytokinesis **IGNORE** two cells are formed / bud separates unqualified
		Total	**10**	

5

(a)	(i)	osmosis ;	1	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**. **DO NOT CREDIT** diffusion
	(ii)	fit between (phospho)lipids / through (phospho)lipid (bi)layer ; via, protein channels / protein pores / aquaporins ;	2	**DO NOT CREDIT** fit through phospholipids (molecules) **DO NOT CREDIT** carrier proteins – if this is used do not award mp 2 **IGNORE** transport proteins
(b)		cell wall ; provides strength / withstands (internal) pressure / prevents cell membrane over expanding / exerts pressure potential ; limits uptake of water ;	2 max	**'has a strong cell wall' = 2 marks** **IGNORE** rigidity (of wall), cytoplasm pushes against cell wall **ACCEPT** stops uptake of water (when turgid)
(c)	(i)	between –1451 and –1799 ;	1	**Ensure figure is a negative number** **CREDIT** a range or single value within this range
	(ii)	*idea of:* **1** plot, percentage plasmolysed against water potential (of solution) / water potential on X axis and % plasmolysed on Y axis ; *idea of:* **2** read down from 50% plasmolysed to water potential ; OR *idea of:* **1** plot, % plasmolysed against sucrose concentration / sucrose concentration on X axis and % plasmolysed on Y axis ; *idea of :* **2** read down from 50% plasmolysed to sucrose concentration **AND** look up equivalent water potential ;	2	**IGNORE** ref to bars / bar graph **ACCEPT** axes wrong way round **ACCEPT** marking points shown correctly on annotated sketch line graph
(d)		*reliable* **R1** observe more pieces of onion (epidermis from each solution) ; **R2** count more cells (in each piece of epidermis) ; **R3** calculate a mean ; **R4** identify / ignore anomalous results ; max 3 *accurate* *idea of:* **A1** use, more / intermediate, concentrations within existing range / smaller gap between concentrations / closer (concentration) values ; **A2** narrower range around 50% plasmolysis / 0.4 - 0.7 mol dm^{-3} / -1120 to -2180 kPa ; **A3** take photographs and mark cells as counting ;	4 max	**DO NOT CREDIT** 'repeats' unless qualified **ALLOW** 'repeat the results / experiment' to indicate more pieces of epidermis **IGNORE** average **ACCEPT** outliers for anomalies **IGNORE** removes / avoids, anomalies **IGNORE** lack of units **ACCEPT** examples of values quoted in between original values e.g. 0.25, 0.35, etc. **ACCEPT** 0.2 **and** 0.9 **ACCEPT** examples of values if clearly showing application of correct narrower range e.g. 0.45, 0.55 , 0.65 For A2 **DO NOT CREDIT** quoted values extend beyond correct narrower range e.g. 0.35, 0.55, 0.75
		Total	12	